REMARKS

Claims 1-4, 8-14, and 43 are now pending in the application. The Examiner is respectfully requested to reconsider and withdraw the rejections in view of the remarks contained herein.

REJECTION UNDER 35 U.S.C. § 103 – WILSON ET AL.

Claims 1, 4, 9, 11, 12, and 43 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Wilson et al. "Thin-film catalyst layers for polymer electrolyte fuel cell electrodes," J. of Applied Electrochemistry, 22 (1992) (hereinafter Wilson). This rejection is respectfully traversed.

The present invention is directed to methods of making membrane electrode assemblies. Embodiments of the present invention include forming a slurry of an ionically conductive material, an electrically conductive material, a catalyst, and a high boiling point casting solvent. The high boiling point casting solvent includes both water and a high boiling point solvent that has a boiling point from about 100°C to about 200°C. See previously presented Claim 1. The Wilson reference does not disclose, suggest, or provide motivation for a skilled artisan to use a casting solvent formed of water and a high boiling point solvent that has a boiling point from about 100°C to about 200°C.

More specifically, the present invention relates to the manufacture of fuel cells, and particularly to methods for making membrane electrode assemblies. One step in embodiments of the present invention involves forming a slurry. Components of the slurry can include an ionically conductive material, an electrically conductive material, a catalyst, and a high boiling point casting solvent. See previously presented Claim 1; paragraph [0005]; and paragraphs [0035] to [0037] for description of the casting solvent. The casting solvent itself can include at least two components, namely water and a high boiling point solvent having a boiling point from about 100°C to about 200°C. See paragraph [0036]. It should be noted that the high boiling point solvent is part of the casting solvent; the two are not the same.

In contradistinction to the present invention, the Wilson reference uses a different casting solvent. Wilson also does not suggest or provide motivation to a skilled artisan to adapt the casting solvent in order to make the casting solvent used in the present invention. In particular, the Wilson reference forms a casting solvent composed of water and glycerol for mixing with the NAFION® and Pt on carbon. See Wilson, section *3.1. Preparation of the catalyst layer inks and electrodes*. The water and glycerol casting solvent of Wilson is not the same as the water and high boiling point solvent of the present invention. More specifically, the glycerol in Wilson does not fall within the definition of a high boiling point solvent that has a boiling point from about 100°C to about 200°C, since glycerol has a boiling point of 297°C.

The high boiling point solvent component of the casting solvent provides several advantages in the present invention. For example, while not limiting to principles by which the present invention operates, it is believed that because the higher boiling point solvents are vaporized at a more controlled and slower rate, the result is a more uniform drying of the coated slurry on the substrate, providing enhanced physical integrity in the resulting decal. The decals also do not suffer from cracking or flaking of the decal from the substrate, and the non-porous polymeric substrates show a high compatibility with such high boiling point solvents. High boiling point solvents are also generally safer and more environmentally friendly. See paragraph [0037]. In addition, in some embodiments a decal formed by the present invention can be heated by an infrared lamp at about 100°C until most of the solvent has evaporated, with a drying time of about 7 minutes. See paragraph [0058]; and see paragraph [0057] for an embodiment of a casting solvent. The casting solvent containing glycerol used in Wilson, with its significantly higher boiling point (297°C compared to the present invention's upper limit of about 200°C) would dry at a substantially slower rate, with the residual glycerol increasing the overall time required for manufacture of a membrane electrode assembly. An increase in dry time would also greatly impact the time the decal spends on the substrate, delaying reuse of the substrate, as in the present invention.

The Office Action notes that a casting solvent mixture formed of glycerol and water, as in the Wilson reference, will have a lower boiling point than does glycerol alone. Similarly, the casting solvent of the present invention comprising water and a high boiling solvent with a boiling point from about 100°C to about 200°C will in most cases have a lower boiling point than the solvent alone. But the key distinction between the Wilson reference and the present invention is that glycerol is not a high boiling point solvent with a boiling point from about 100°C to about 200°C. And Wilson does not provide any suggestion or motivation to a skilled artisan to use such a solvent. For example, there is no disclosure, appreciation, or motivation in Wilson to reuse the substrate, making the decal drying time an important parameter. Using glycerol in the casting solvent, with its very high boiling point, is contrary to the present inventive method that reuses the substrate.

In close, the Wilson reference fails to disclose, suggest, or motivate a skilled artisan to use a high boiling point solvent, having a boiling temperature from about 100°C to about 200°C, within the casting solvent as in the present invention. The high boiling point solvent of the present invention does not include glycerol, as glycerol is expressly precluded due its boiling point of 297°C. Consequently, the present invention is not obvious in view of the reference. Applicant respectfully submits the Claims are patentable over the Wilson reference and requests reconsideration of the claims.

Applicants note the Examiner's additional rejections pertain to claims dependent on independent Claim 1. Applicants submit that these rejections are traversed, as the preceding arguments have demonstrated that Claim 1 is not obvious in view of the Wilson reference, and hence all pending dependent claims (*i.e.*, Claims 2-4 and 8-14) are thereby not obvious. Withdrawal of the rejections and reconsideration are respectfully requested.

CONCLUSION

It is believed that all of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider and withdraw all presently outstanding rejections. It is believed that a full and complete response has been made to the outstanding Office Action and the present application is in condition for allowance. Thus, prompt and favorable consideration of this amendment is respectfully requested. If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at (248) 641-1600.

Respectfully submitted,

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By: Anna M Budde
Anna M. Budde, Reg. No. 35,085

HARNESS, DICKEY & PIERCE, P.L.C.
P.O. Box 828
Bloomfield Hills, Michigan 48303
(248) 641-1600

WAZ/akb